# Status of the Barred Owl (*Strix varia*) in Alberta

Fish & Wildlife Division

RESOURCE DATA AND SPECIES AT RISK SECTION

Alberta Wildlife Status Report No. 56

Alberta Conservation Association

Alberta SUSTAINABLE RESOURCE DEVELOPMENT

# Status of the Barred Owl (*Strix varia*) in Alberta

Prepared for:
**Alberta Sustainable Resource Development (SRD)**
**Alberta Conservation Association (ACA)**

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# PREFACE

Every five years, the Fish and Wildlife Division of Alberta Sustainable Resource Development reviews the general status of wildlife species in Alberta. These overviews, which have been conducted in 1991 (*The Status of Alberta Wildlife*), 1996 (*The Status of Alberta Wildlife*) and 2000 (*The General Status of Alberta Wild Species 2000*), assign individual species "ranks" that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A key objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the general status exercise, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are *At Risk* or *May Be At Risk* in the province, that are of uncertain status (*Undetermined*), or that are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fish and Wildlife Division of Alberta Sustainable Resource Development. They are intended to provide detailed and up-to-date information that will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information that will assist Alberta's Endangered Species Conservation Committee in identifying species that may be formally designated as *Endangered* or *Threatened* under Alberta's *Wildlife Act*. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

## EXECUTIVE SUMMARY

The barred owl (*Strix varia*) is currently listed in Alberta as a *Sensitive* species based on its requirement of large, continuous blocks of mature forest habitat (Alberta Sustainable Resource Development 2001). Habitat for the barred owl is under pressure because of increasing demand on forest resources as well as an expanding industrial footprint in the province. Although the long-term effects of these activities on barred owls in Alberta are unknown, population declines as a result of forest harvesting have been noted in other parts of the species' North American range. This report summarizes available information on the barred owl for the purpose of updating its status in Alberta.

In Alberta, the barred owl is associated with old mixedwood forest stands. It selects old mixedwood stands because preferred nesting sites are often most abundant in these habitats. Barred owls nest most often in tree cavities formed by fallen branches and broken tops of balsam poplar (*Populus balsamifera*) and aspen (*P. tremuloides*) trees. The occurrence of barred owls near wetlands and riparian areas can be explained in part by the abundance of old poplar stands in these areas and, therefore, suitable nesting sites for barred owls. Uplands are also used, provided that suitable nest sites are available.

Barred owl populations are generally stable or increasing throughout North America. However, in the east, excessive habitat loss and fragmentation has resulted in local population declines and extirpation in some instances. In the Pacific Northwest, habitat alteration and increasing forest fragmentation has led to the movement of the species into previously unoccupied areas. Monitoring programs and directed studies are required to determine the longer-term trends in barred owl populations in Alberta, regionally and across North America.

Potential conflict between barred owl habitat supply and land use activities is directly related to forest harvesting practices in Alberta. Operating guidelines requiring that the oldest stands be harvested first will result in a significant decrease in the amount of old growth forest on the landscape. Another potential threat is proposals to allow harvesting within protective buffers beside watercourses. Considering the incidental loss of old growth habitat elements through forestry, fire, and the expanding industrial footprint, the effects will likely be severe and long-term for barred owls in some parts of the province.

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## INTRODUCTION

The barred owl (*Strix varia*) is a forest-dwelling resident of the Rocky Mountain, Parkland, Foothills, and Boreal Forest natural regions of Alberta. Early observations in this province date back to the 1930s (Preble 1941), with the first confirmed breeding occurrence in 1966 (Jones 1966). In recent years, an appreciable amount of information has been collected by scientists and naturalists eager to further document the ecology of barred owls in the province. At the same time, rapidly increasing resource extraction and development in Alberta and across Canada have raised concerns about degradation and loss of habitat for barred owls and other forest-dwelling raptors (Kirk and Hyslop 1998). In Alberta and Saskatchewan, the forest industry has been proactive about initiating studies of barred owl habitat use in order to identify potential conflicts with current harvesting practices. The barred owl is currently listed as *Sensitive** in the province of Alberta because of its requirement for large stands of mature forest (Alberta Sustainable Resource Development 2001). This report is intended to compile and summarize all existing information on the barred owl for the purpose of updating the status of the species in Alberta.

## HABITAT

Throughout its North American range, the barred owl is associated with mixed conifer-deciduous forests (i.e., mixedwood forest). Often associated with riparian areas and wetlands, the species is also found in uplands where suitable habitat exists. In eastern North America, barred owls inhabit mature and old hemlock, maple, oak and mixedwood forest types (Nicholls and Warner 1972, Fuller 1979, Elody and Sloan 1985). They avoid agriculture, fragmented woodlots and young forests in New Hampshire, Connecticut, Ontario and New Jersey (Smith 1978, Bosakowski 1994, Van Ael 1996). In Alberta and Saskatchewan, old mixedwood forest is the primary habitat for barred owls during the breeding season (Mazur et al. 1998, Takats 1998, Olsen 1999). When forest clearings are abundant, barred owls are susceptible to predation by great horned owls (*Bubo virginianus*) (Laidig and Dobkin 1995). In New Jersey, declining populations have been attributed to habitat loss and fragmentation resulting from logging and conversion to agricultural land (Bosakowski et al. 1987). In western North America, barred owls occur in mature and old mixedwood and conifer forests (Wright and Hayward 1998), sometimes in association with spotted owls (*Strix occidentalis*) (Dunbar et al. 1991), and also in second-growth forest (Leder and Walters 1980, Hamer 1988).

Habitat selection by barred owls can be explained, for the most part, by nest site and prey availability. Barred owls are among the largest cavity nesters in North America. Although platforms (Mazur et al. 1997), cliff banks (Shakelford and Earley 1996) and ground nests (Robertson 1959) have been reported as nesting sites, tree cavities appear to be preferred, possibly for microclimatic characteristics, and/or protection from predators (Postupalsky et al. 1997). In two studies, diameter at breast height (dbh) was greater for nesting sites than it was for random sites, suggesting that relatively large trees, which contain relatively large cavities, are required (Devereux and Mosher 1984, Olsen 1999). Reported nest tree diameters are 49 cm in Michigan (Postupalsky et al. 1997) and 61 cm in the central Appalachians (Devereux and Mosher 1984). In Alberta, most barred owl nests have been found in dead, hollow snags of balsam poplar (*Populus balsamifera*) and aspen (*P. tremuloides*) averaging 74 cm dbh in the Foothills Natural Region (Takats 1998), and 52 cm dbh in the Boreal Forest Natural Region (Olsen 1999). In Alberta, trees of this species and of this size would be greater than 120 years in age (Alberta Environmental Protection 1985, Lee et al. 1995b).

* See Appendix 1 for definitions of selected status designations.

Canopy cover and stand structure of the surrounding forest are important components of breeding habitat for barred owls. As the owlets leave the cavity at an early age (4–5 weeks old), the surrounding forest becomes an important surrogate nest while the young are flightless (10–12 weeks old). Perches and roost trees in close proximity to the nesting cavity are important habitat during this stage of development. In Alberta, white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) provide adequate shade and protective cover post-fledging (Olsen unpubl. data). The use of nesting cavities in deciduous trees during egg laying and brood rearing, followed by preference for conifers post-fledging, may explain why barred owls are more likely to breed in mixedwood stands compared to other stand types.

## CONSERVATION BIOLOGY

The barred owl takes its name from the Latin word *varia*, describing the variegated streaking pattern of the species' body plumage. Greyish-brown in color, the barred owl has a rounded head, white facial discs, no ear tufts and dark brown eyes. Although similar in morphology, males are smaller than females in size and weight (males average 632 g, females average 801 g; Johnsgard 1988). Breeding pairs are known for their elaborate repertoire of calls, including a distinctive eight-syllable vocalization that can be described phonetically as "Who cooks for you, who cooks for you all?" Although this call can be heard year-round, it is most commonly heard early in the breeding season (March-April) when courtship and territorial activities commence.

Presumed monogamous, barred owls breed once per season unless the first clutch is lost, in which case a second or third breeding attempt is possible (Bent 1938). Nesting begins with the laying of the first egg in late winter or early spring, depending on latitude. In the central Appalachians, the mean egg date reported by Devereux and Mosher (1984) was 20 March. Clutch size can range from one to four eggs, but 2–3 is typical. Murray (1976) reported a mean clutch size of 2.41 based on 315 samples (Murray 1976). Incubation lasts 28–33 days (Johnsgard 1988) and begins before the last egg has been laid, resulting in asynchronous hatching. The mean hatching date in the central Appalachians was 10 April (Devereux and Mosher 1984). Brooding continues until the youngest chick is several weeks old. After brooding, the owlets remain in the nest for several weeks and are fed by the adults. Once the young become too large for their cavity, they perch in trees surrounding the nest and continue to be fed by the parents. After fledging, the juveniles remain within the family group for up to four months before dispersing (Dunstan and Sample 1972, Johnsgard 1988).

There is no detailed information on sex ratio, average age of breeding, or survivorship of barred owls. The oldest known individual lived 18 years 2 months in the wild (Klimkiewicz and Futcher 1989). First breeding is presumed to be at two years of age (Mazur and James 2000); however, successful nesting of yearlings of the congeneric spotted owl (*Strix occidentalis*) has been reported (Hamer et al. 1994). Breeding is presumed to be annual, but nonbreeding years are common for some individuals (L. Priestley, pers. comm.).

The barred owl is highly territorial and responds aggressively to neighbours and call playbacks. Breeding season territories are generally maintained between years, but can increase considerably during the winter months depending on prey availability and habitat characteristics. Several studies have estimated barred owl home range size from radio telemetry data. In a Minnesota study, Nicholls and Fuller (1987) reported home range estimates averaging 273 ha (n = 13). Elody and Sloan (1985) reported an estimate of 282 ha based on a sample of seven individuals in Michigan. In Alberta, barred owl breeding season home range size was estimated at 337 ha (n = 9, Olsen 1999). In a Washington study, Hamer (1988) reported a breeding season estimate of 321 ha (n = 8), and a nonbreeding

estimate of 664 ha (n = 10). In Saskatchewan, home range size was estimated to be 149 ha (n = 12) in the breeding season, and 1234 ha (n = 13) in the nonbreeding period (Mazur et al. 1998).

## DISTRIBUTION

***1. Alberta*** – The barred owl has been recorded as far north as High Level, Alberta and the most southerly records are from the Cardston area, near the Montana border (see Figure 1). The earliest recorded occurrence of the species is an observation made near Fort McMurray, Alberta in 1934 (Preble 1941). It is not known whether the species was resident before this time, because pre-1900 ornithological records for the region are sparse. Evidence for a breeding population was obtained in 1949, when a family of barred owls was observed on the Prairie River near Slave Lake (Grant 1966). The first confirmed nesting site was not located until nearly two decades later, in Edmonton, Alberta (Jones 1966). During the 30 years following the first breeding observation, only eight nesting sites were confirmed for the entire province, as reported by Boxall and Stepney (1982). More recent observations have been made in the Foothills, Mountains, Parkland and Boreal Forest natural regions (Boxall 1986, Jones 1987). Presently, over 60 breeding records are known (Priestley in press).

***2. Other areas*** – The barred owl occurs throughout the eastern United States, from the Atlantic coast to the Great Plains and from eastern Texas through Minnesota (Johnsgard 1988). Its range extends into southern Canada through Ontario and Quebec, and eastward into New Brunswick, Nova Scotia and Prince Edward Island. In western Canada, it occurs throughout Manitoba, Saskatchewan and Alberta, and into southern portions of the Northwest Territories and Yukon (see Figure 2). In recent decades, the range of the species has been expanding westward (Houston and McGowan 1999). Breeding occurrences for the interior of British Columbia (Grant 1966), Montana (Shea 1974), Vancouver Island (Harrington-Tweit and Mattocks 1984), Washington (Rogers 1966), Oregon (Taylor and Forsman 1976) and California (Evens and LeValley 1982) confirm that the species has become well established in the Pacific and Inland Northwest (Dark et al. 1998). Range expansion of the barred owl has resulted in overlap with the northern spotted owl, as these species have similar habitat requirements and both forage primarily on nocturnal prey (Taylor and Forsman 1976). Interspecific competition and hybridization (Hamer et al. 1994) are jeopardizing spotted owl populations (Kelly et al. 2003) where these congeners overlap in range. There is also an isolated population of barred owls in the central plateau of Mexico.

## POPULATION SIZE AND TRENDS

***1. Alberta*** – Although occurrence records suggest that the barred owl is only sparsely distributed in the province (Semenchuk 1992), field surveys indicate that it can be locally abundant in areas of suitable habitat. Field surveys typically use transect-based point counts whereby the identity of calling individuals is not known and therefore only relative abundance can be determined. Owl surveys are also non-random, because they rely on road access, potentially biasing samples towards certain habitat types where roads more commonly occur. Furthermore, the lack of a standard protocol for conducting owl surveys has hampered comparisons between studies with differing methodology, intensity and replication. In 2003, Bird Studies Canada initiated a monitoring program to determine population trends of nocturnal owls across a large geographical area over the longer term (L. Priestley, pers. comm.). Nonetheless, existing survey data collected prior to this program can be useful for determining species' distribution and relative abundance in localized areas.

Owl surveys conducted near Calling Lake, Alberta from 1994–1996 (Hannon unpubl. data) demonstrated that after logging there was a 33%

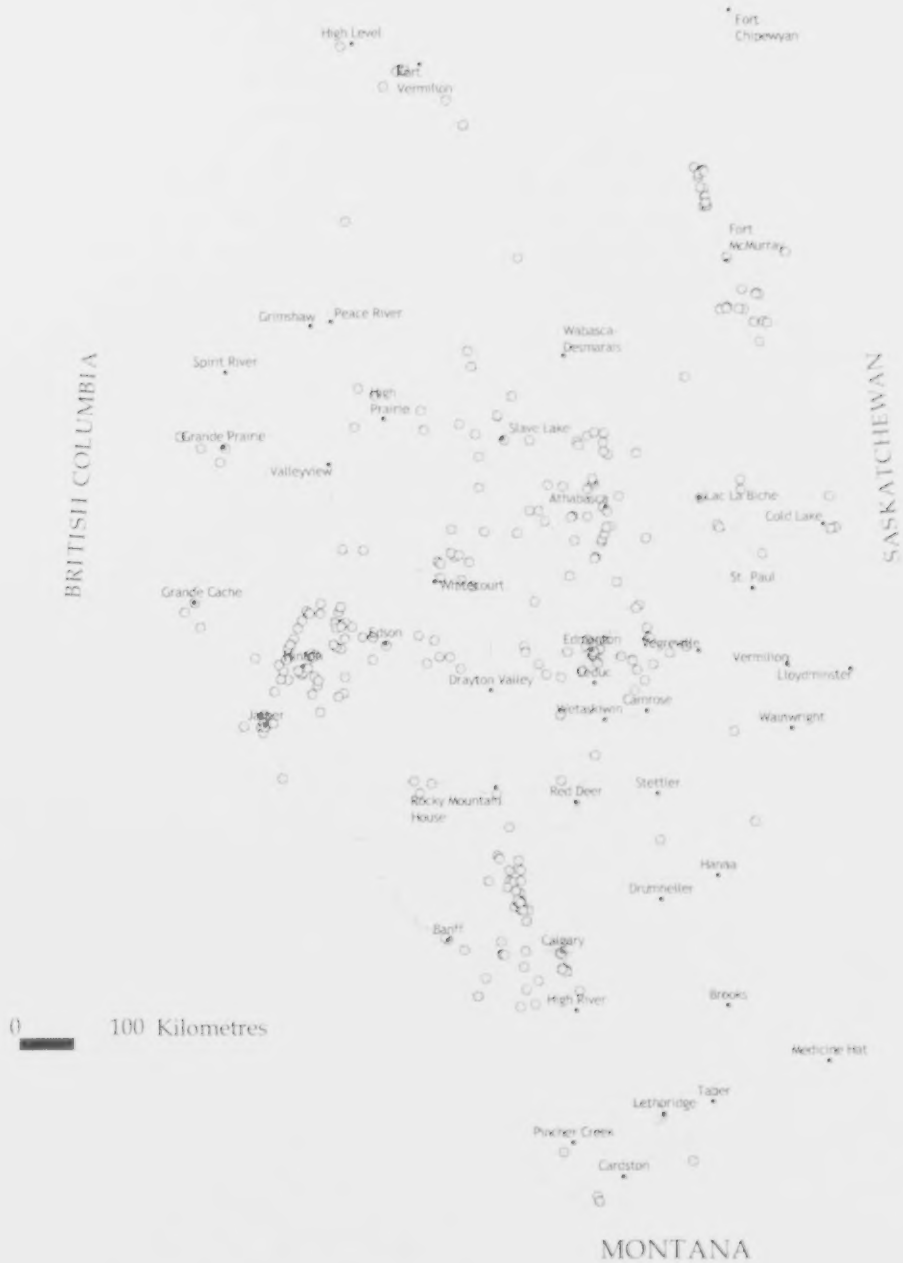


Figure 1. Barred owl records of occurrence from the Biodiversity/Species Observation Database maintained by Alberta Sustainable Resource Development and the Alberta Conservation Association. A large proportion of these records is compiled in Priestley (in press).

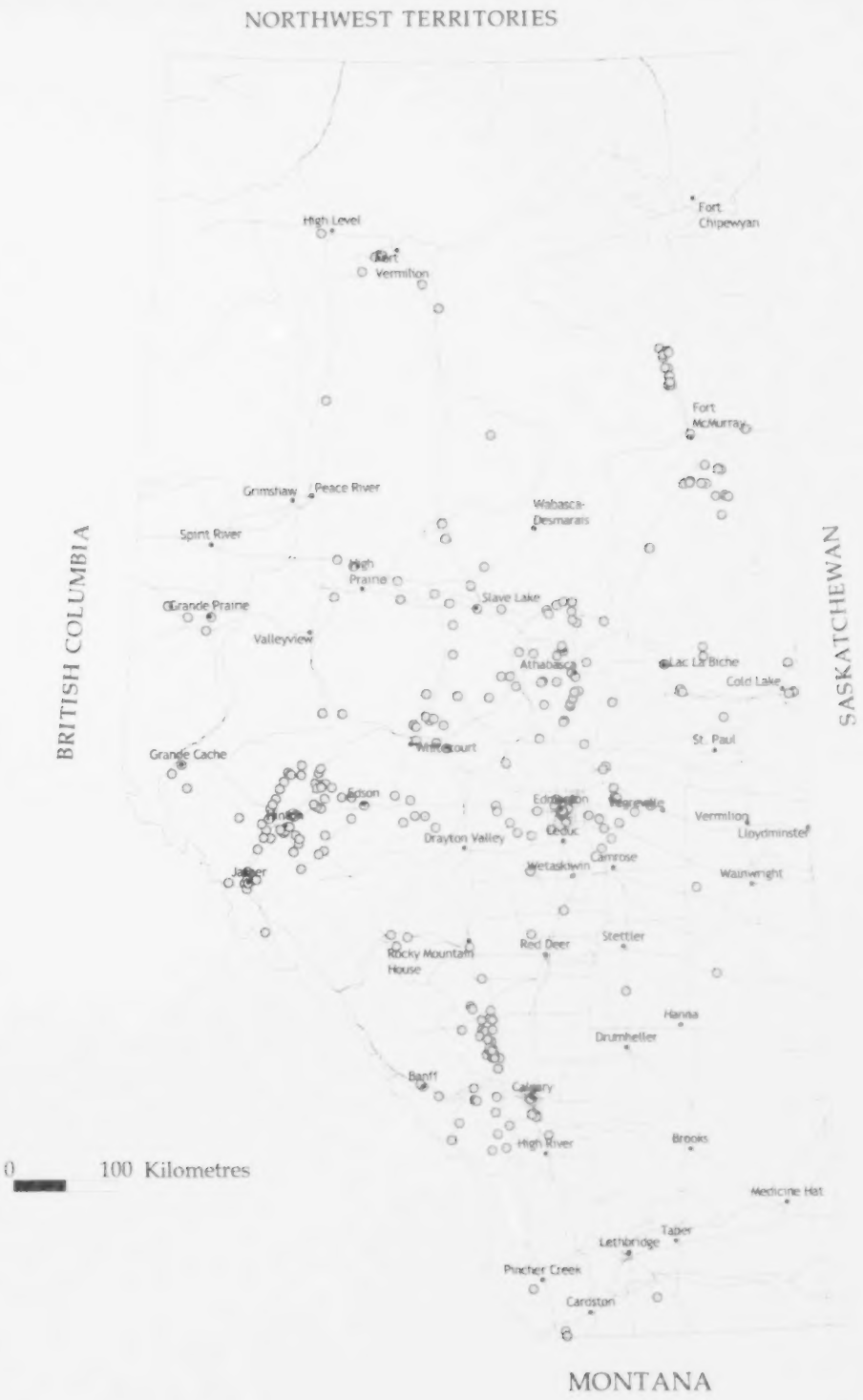


Figure 1. Barred owl records of occurrence from the Biodiversity/Species Observation Database maintained by Alberta Sustainable Resource Development and the Alberta Conservation Association. A large proportion of these records is compiled in Priestley (in press).

Figure 2. Distribution of the barred owl in North America (adapted from Johnsgard 1988).

decline in barred owl detections (mean density 0.1 owls/km$^2$) and an increase of 60% in detections of great horned owls (0.06 owls/km$^2$), which prey on barred owls. In 1997, a follow-up study examined old mixedwood forest adjacent to burns, clearcuts and contiguous forest. Barred owl detections were greatest in the contiguous forest, and lower in the young and burned forest landscapes (Olsen and Hannon unpubl.). Conversely, great horned owls were less abundant in the contiguous forest compared to the young and burned samples (Olsen and Hannon unpubl.). Detection of both species was greatest at the forest-cutblock interface, suggesting that these species have the greatest spatial overlap in fragmented landscapes (Olsen and Hannon unpubl.).

Owl surveys conducted in 1995 and 1996 indicated that barred owls are one of the most common breeding residents, equal in abundance to the great horned owl, in the Foothills Natural Region (Takats 1998). During this study, the number of barred owl detections decreased from 33 in 1995 to 25 in 1996, and the number of great horned owl detections increased from 25 to 30 (Takats 1998). Analysis of barred owl survey data from this study and three others conducted in the Foothills Natural Region between 1999 and 2001 resulted in a density estimate (95% CI) of 0.013–0.047 owls/km$^2$ for that region (Piorecky 2003). Given the patchy distribution of suitable breeding habitat for the species, however, it is overly simplistic to apply this density over the forested land base of Alberta in an attempt to obtain a provincial population estimate. The species is comparatively rare in the province, with less than 70 nesting records (Priestley, in press) and only 145 auditory occurrences (territorial birds calling) documented in the last 100 years (Alberta Sustainable Resource Development and the Alberta Conservation Association 2000). Relative to more common owl species in Alberta, surveys in 2004 showed that at 670 survey points, great horned owls and northern saw-whet owls (*Aegolius acadicus*) were both about 10 times more common than were barred owls (Beaverhill Bird Observatory, unpubl. data) despite the fact that many of the routes were selected in a non-random fashion and where some were chosen specifically with the hope of encountering species like the barred owl.

Although recent studies have shown populations of barred owl to be declining over the short term and in localized areas, some authors speculate that the species is increasing in abundance and distribution in the province as a whole (Boxall and Stepney 1982). Longer-term studies over large geographical areas are required to determine population trajectories for this species, especially considering the scale of industrial forestry operations in the province at present. Measures of habitat condition and prey availability should also be made, to control for annual variability in habitat quantity and quality over time. Volunteer owl surveys are an excellent monitoring tool, aided by standard protocols and consistent methodologies over the longer term (Takats 2001). The barred owl does not experience population cycles. Because the species is a generalist predator, populations are not susceptible to prey-induced population fluctuations observed in other forest owls of the region (i.e., boreal owl [*Aegolius funereus*] and northern saw-whet owl).

***2. Other Areas*** – Currently, the Canadian population of barred owls is estimated at 10 000–50 000 pairs (Kirk and Hyslop 1998). Throughout North America, populations are stable or increasing. From 1966–1996, Breeding Bird Survey data showed a significant increase of 3.3% across the entire North American population (Sauer et al. 2003). From 1959–1988, populations in North America increased by 0.7% according to Christmas Bird Count data (Sauer et al. 1996), although it is clear that the survey protocol involved is relatively poor for the detection of nocturnal raptors. Despite these suggestions of slight population increases, more detailed studies in Illinois (Sauer et al. 2003) and New Jersey (Bosakowski 1994) have documented population declines as a result of extensive forest clearing and habitat loss.

Conversely, in the Pacific Northwest, barred owls have increased in distribution and abundance to the point where they are now believed to be displacing spotted owls (Dark et al. 1998, Kelly et al. 2003).

## LIMITING FACTORS

Reductions in average stand age and stand structure are the primary threats to barred owl populations in Alberta. Although there has never been a timber supply analysis done specifically for barred owls, Schneider et al. (2003) showed that old growth forest in Alberta will be virtually eliminated within 60 years at current harvesting intensities. Potential changes that would affect barred owls include a younger and more fragmented forest landscape, a reduction in snag density and fewer potential nesting sites, as well as increased competition by great horned owls. In the east, barred owl populations have declined as a result of extensive habitat loss and competition with great horned owls in fragmented areas (Bosakowski 1994); the persistence of the species is directly related to the continued existence of large contiguous tracts of unfragmented habitat (Laidig and Dobkin 1995), which is unlikely in most managed forests in Alberta given present management guidelines (Alberta Government 1994).

Barred owls preferentially select old mixedwood forests, which are the stands with the highest density of large diameter snags (Lee et al. 1995a, Lee 1998). In Alberta, policy requires that the oldest stands be harvested first (Alberta Government 1994), creating conflict between forest management and habitat supply for species dependent on old growth forest. Moreover, present forestry guidelines in Alberta permit harvesting of re-grown aspen-dominated stands at the age of 70 years. As it takes a minimum of 100 years to produce barred owl nesting trees, there appears to be a strong conflict between present harvesting guidelines and barred owl conservation. Large diameter trees and snags are required within cutblocks to provide suitable and potentially suitable nesting sites for barred owls within the regenerating forest. Presently, riparian buffer strips, where logging is excluded, are the greatest source of potential nesting sites for barred owls in the managed forests of Alberta. The management of such buffer areas for old growth features such as barred owl nesting trees will be critical to the conservation of this species in the province. Proposals to allow harvesting within such protective buffers should be evaluated in consideration of the habitat needs of barred owls and other old-growth-dependent species.

## STATUS DESIGNATIONS*

***1. Alberta*** – In 1985, the barred owl was listed as "Status Undetermined" because information on the species was too limited at the time to allow a credible designation (Alberta Fish and Wildlife 1985). In 1991, the species was placed on the "Yellow List" for sensitive species that are not at risk, but require special attention because of their rarity, distribution or habitat requirements (Alberta Forestry, Lands and Wildlife 1991). In 1996, that designation remained unchanged because populations were believed to be declining in the Parkland Natural Region and habitat for the species was considered to be at risk elsewhere (Alberta Environmental Protection 1996). Presently, the barred owl is listed as *Sensitive* in recognition of the apparent conflict between known habitat requirements for the species and present forest management practices (Alberta Sustainable Resource Development 2001). The barred owl is also currently listed on the Alberta Natural Heritage Information Centre's Watch List, and is listed as S3/S4 provincially (Alberta Natural Heritage Information Centre 2002a). It is ranked *Sensitive* in Alberta by the Canadian Endangered Species Conservation Council (CESCC 2001).

***2. Other Areas*** – The barred owl has not been evaluated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Canadian Endangered Species Conservation

* See Appendix 1 for definitions of selected status designations.

Council (CESCC) ranks the barred owl as *Sensitive* in Saskatchewan and *Secure* in British Columbia, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island (CESCC 2001). Globally, the species is ranked as G5—demonstrably widespread, abundant and secure (NatureServe 2004). In the United States and Canada the barred owl is ranked as N5—common, widespread and abundant (NatureServe 2004). At the state level, the barred owl is listed as S5—Secure or S4—Apparently Secure in Alabama (S5), Arkansas (S4), Connecticut (S5), Georgia (S5), Idaho (S4), Illinois (S5), Indiana (S4), Iowa (S5), Kansas (S4), Kentucky (S5), Louisiana (S5), Maine (S5), Maryland (S5), Massachusetts (S5), Michigan (S5), Mississippi (S5), Montana (S4), New Hampshire (S5), New York (S5), North Carolina (S4), Ohio (S5), Oklahoma (S4/S5), Pennsylvania (S5), Rhode Island (S4/S4), Tennessee (S5), Texas (S5), Vermont (S5), Virginia (S5), Washington (S5), West Virginia (S5) and Wisconsin (S4) (NatureServe 2004). At the state level, the barred owl is listed as S3—Vulnerable or S2—Imperiled in Delaware (S2), District of Columbia (S2), Nebraska (S2) and New Jersey (S3). At the provincial level, the barred owl is listed as S5—Secure or S4—Apparently Secure in British Columbia (S5), New Brunswick (S5), Nova Scotia (S5), Ontario (S4/S5), Prince Edward Island (S5) and Quebec (S5) (NatureServe 2003). It is listed as S3—Vulnerable or S2—Imperiled in Manitoba (S3/S4) and Saskatchewan (S3/S2) (NatureServe 2004).

## RECENT MANAGEMENT IN ALBERTA

The barred owl has been used as a focal species (Lambeck 1997) in eastern North America (USDA 1985, 1986) and western Canada (James et al. 1995). Given its habitat requirements and large home range size, the species has been proposed as an indicator of ecosystem health for old growth biological communities in the boreal forest (James et al. 1995). Monitoring is necessary to determine whether population changes are occurring as a result of land use activities, climate change and an increasing industrial footprint in the province. The Alberta Nocturnal Owl Survey aims to provide inventory data on the distribution and relative abundance of barred owls and other sensitive species over the longer term. In conjunction with similar studies across Canada and elsewhere, the Nocturnal Owl Survey program will provide valuable information that is otherwise not captured on volunteer owl monitoring programs such as the Breeding Bird Survey, May Species Count, Edmonton Owl Prowl and Alberta Owl Prowl.

## SYNTHESIS

The barred owl was first detected in the province of Alberta in the 1930s. Whether it was a relatively common resident here before that time is not known, but increased access to forested areas in the province and interest in owl surveys have resulted in a substantial increase in our knowledge of the species in the province in the last 15 years. Occurrence records and field surveys indicate that the species is widespread and locally abundant in the Parkland, Foothills, and Boreal Forest natural regions. Detailed studies have shown that its breeding habitat requirements are best satisfied by old mixedwood forest. Old mixedwood is selected because of the abundance of suitable nesting cavities in very old balsam poplar and aspen trees in these forest types. Present forest management practices will remove much of this habitat type in managed forest stands over the next few decades. Present forest management practices also make it unlikely that such habitat elements will be created in regenerating stands in managed forest before harvest is re-initiated. Therefore, riparian areas and uplands with a high number of large diameter (>50 cm) trees will continue to be an important source of natural nesting sites for the barred owl in Alberta. Careful management of these areas, designed to preserve and to continue to produce such habitat elements, will be necessary to prevent the disappearance of the barred owl over most of its range in Alberta.

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## Appendix 1. Definitions of selected legal and protective designations.

### A. The General Status of Alberta Wild Species 2000 (after Alberta Sustainable Resource Development 2001)

| 2000 Rank | 1996 Rank | Definitions |
|---|---|---|
| At Risk | Red | Any species known to be *At Risk* after formal detailed status assessment and designation as *Endangered* or *Threatened* in Alberta. |
| May Be At Risk | Blue | Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment. |
| Sensitive | Yellow | Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk. |
| Secure | Green | Any species that is not *At Risk*, *May Be At Risk* or *Sensitive*. |
| Undetermined | Status Undetermined | Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status. |
| Not Assessed | n/a | Any species known or believed to be present but which has not yet been evaluated. |
| Exotic/Alien | n/a | Any species that has been introduced as a result of human activities. |
| Extirpated/Extinct | n/a | Any species no longer thought to be present in Alberta (*Extirpated*) or no longer believed to be present anywhere in the world (*Extinct*). |
| Accidental/Vagrant | n/a | Any species occurring infrequently and unpredictably in Alberta, i.e., outside its usual range. |

### B. Alberta Wildlife Act/Regulation

Species designated as *Endangered* under Alberta's *Wildlife Act* include those listed as *Endangered* or *Threatened* in the Wildlife Regulation.

| | |
|---|---|
| Endangered | A species facing imminent extirpation or extinction. |
| Threatened | A species that is likely to become endangered if limiting factors are not reversed. |

### C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2003)

| | |
|---|---|
| Extinct | A species that no longer exists. |
| Extirpated | A species that no longer exists in the wild in Canada, but occurs elsewhere. |
| Endangered | A species facing imminent extirpation or extinction. |
| Threatened | A species that is likely to become endangered if limiting factors are not reversed. |
| Special Concern | A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. |
| Not at Risk | A species that has been evaluated and found to be not at risk. |
| Data Deficient | A species for which there is insufficient scientific information to support status designation. |

**Appendix 1** continued.

**D. Heritage Status Ranks: Global (G), National (N), Sub-National (S)** (after Alberta Natural Heritage Information Centre 2002b, NatureServe 2004)

| | |
|---|---|
| G1/N1/S1 | 5 or fewer occurrences or only a few remaining individuals. May be especially vulnerable to extirpation because of some factor of its biology. |
| G2/N2/S2 | 6 to 20 or fewer occurrences or with many individuals in fewer locations. May be especially vulnerable to extirpation because of some factor of its biology. |
| G3/N3/S3 | 21 to 100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations). May be susceptible to extirpation because of large-scale disturbances. |
| G4/N4/S4 | Typically > 100 occurrences. Apparently secure. |
| G5/N5/S5 | Typically > 100 occurrences. Demonstrably secure. |
| GX/NX/SX | Believed to be extinct or extirpated, historical records only. |
| GH/NH/SH | Historically known, may be relocated in the future. |
| GNR/NNR/SNR | Unranked—conservation status not yet assessed. |

**E. United States Endangered Species Act** (after National Research Council 1995)

| | |
|---|---|
| Endangered | Any species which is in danger of extinction throughout all or a significant portion of its range. |
| Threatened | Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. |

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